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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/599,539	08/09/2007	Shuichi Fujii	81872.0127	1506

26021 7590 09/01/2010  
Hogan Lovells US LLP  
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SUITE 1400  
LOS ANGELES, CA 90067

EXAMINER
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BOURKE, ALLISON

ART UNIT	PAPER NUMBER
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1795

NOTIFICATION DATE	DELIVERY MODE
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09/01/2010

ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/599,539	<b>Applicant(s)</b> FUJII ET AL.	
	<b>Examiner</b> Allison Bourke	<b>Art Unit</b> 1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 30 July 2010 and 09 April 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-3,5,6,8-10,13,14 and 17-22 is/are pending in the application.
- 4a) Of the above claim(s) 14 and 17-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5,6,8-10,13,21 and 22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>3/5/2010, 8/6/2010</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

1. The amendment filed April 9, 2010 does not place the application in condition for allowance.

### ***Remarks***

2. Claims 1-3, 5-6, 8-10, 13-14, 17-22 are pending in the application, while claims 14, 17-20 are withdrawn.

### ***Election/Restrictions***

3. Applicant's election without traverse of group I (claims 1-3, 5-6, 8-10, 13 and 21-22) in the reply filed on July 30, 2010 is acknowledged.
4. Claims 14, 17-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on July 30, 2010.

### ***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 1-3, 5-6, 8-10, 13 and 21-22 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 1, it is unclear if the surface electrode is the at least three surface bus bar electrodes and the plurality of finger electrodes, because the surface electrode and the at least three surface bus bar electrodes/plurality of finger electrodes

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are both on the light receiving surface. For the purposes of this office action, the surface electrode is assumed to be the at least three surface bus bar electrodes and the plurality of finger electrodes.

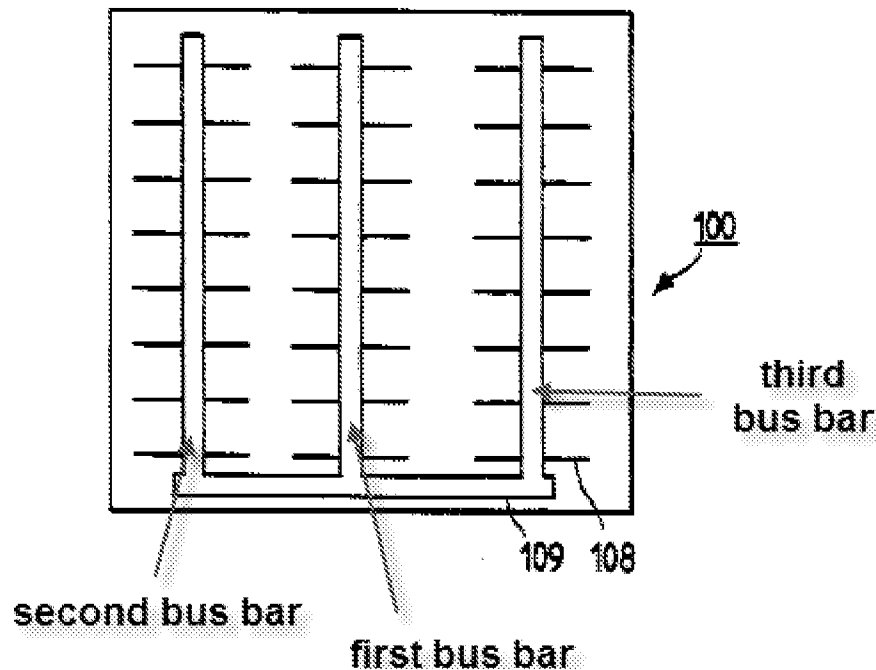
***Claim Rejections - 35 USC § 103***

7. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

8. Claims 1-3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami (US 5,380,371).

Regarding claims 1, 3 and 21, Murakami discloses a solar cell element (Fig. 1-4) comprising: a substrate (103-105) for the solar cell element comprising a light receiving surface (top 105); a surface electrode (108, 109) on the light receiving surface (Fig. 1); wherein the light receiving surface comprises at least three bus bar electrodes (109, Fig. 1C) and a plurality of finger electrodes (108) connected to adjacent surface bus bar electrodes of the at least three surface bus bar electrodes (Fig. 1C), and wherein the at least three surface bus bar electrodes comprise a first, a second and a third surface bus bar electrode (Fig. 1C, see below), the second and the third surface bus bar electrodes are respectively located on both sides of the first bus bar electrode with a gap and arranged symmetrically with each other with respect to the first surface bus bar electrode (Fig. 1C, see below) and the finger electrodes have widths of not less than 0.05 mm (C8/L34-35).

**FIG. 1C**



Murakami discloses the area of the surface electrodes are appropriately designed so as not to prevent light from entering the semiconductor layer and to efficiently collect electric current (C8/L60-63), but does not explicitly disclose the bus bar electrodes have widths of not less than 0.5 mm and not more than 2 mm and the finger electrodes have widths of not less than 0.06 mm and not more than 0.09 mm. As the amount of incident light and electrical output ability of the electrodes are variables that can be modified, among others, by adjusting the finger electrode width, with said incident light increasing and electrical output decreasing as finger electrode width is decrease, the precise finger electrode width would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was

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made. As such, without showing unexpected results, the claimed finger electrode width cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the finger electrode width in the apparatus of modified Murakami to obtain the desired balance between the amount of incident light and the electrical output of the electrodes to efficiently collect the electric current (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

Regarding claim 2, modified Murakami discloses all the claim limitations as set forth above and Murakami additionally discloses the solar cell elements each have a rectangular shape whose one side is not less than 100 mm and not more than 350 mm in length, and another side is not less than 100 mm and not more than 350 mm in length (C11/L24).

9. Claims 5-6 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami (US 5,380,371) in view of Fujii et al. (US 2003/0178057).

Regarding claims 5-6, 8, 10, Murakami discloses all the claim limitations as set forth above and additionally discloses an opposite conductivity-type diffusion layer (103, 105) but does not explicitly disclose the solar cell elements comprise on the light receiving surface side thereof an opposite conductivity-type diffusion layer having a sheet resistance of not less than  $60\Omega/\square$  and not more than  $300\Omega/\square$  and the solar cell elements

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on the light receiving surface side on thereof fine irregularities having widths and heights of 2  $\mu\text{m}$  or less and an aspect ratio of 0.1-2.

Fujii discloses a solar cell (Fig. 1) with a surface electrode (4) on an opposite conductivity-type diffusion layer (1a) part of the semiconductor substrate having a sheet resistance of  $60\Omega/\square$ - $300\Omega/\square$  that will have good electric properties [0027]. Fujii additionally discloses the substrate having microscopic protrusions and recesses on the surface of the semiconductor substrate so as to introduce as much light incident on the solar cell as possible into the semiconductor substrate, and to trap as much light introduced into the semiconductor substrate as possible within the semiconductor substrate [0007]. Fujii also discloses the protrusions having widths and heights of 2  $\mu\text{m}$  or less [0057] and an aspect ratio of 0.1-2 [0058] in order to shorten time of manufacturing [0057], optimize the reflectance and the susceptibility to being damaged during manufacturing [0058].

It would have been obvious to one having ordinary skill in the art at the time of the invention to have an opposite conductivity type diffusion layer with a sheet resistance of  $60\Omega/\square$ - $300\Omega/\square$  because of the good electric properties. Additionally, it would have been obvious to one having ordinary skill in the art at the time of the invention to introduce irregularities in the solar cell elements of Murakami, as taught by Fujii, maximized introduced light and to trap light introduced into the semiconductor substrate. Further, it would have been obvious to one having ordinary skill in the art at the time of the invention to provide the irregularities having widths and heights of 2  $\mu\text{m}$  or less and an aspect ratio of 0.1-2 in the device of Murakami, as taught by Fujii, in

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order to shorten time of manufacturing, optimize the reflectance and the susceptibility to being damaged during manufacturing.

Regarding claim 9, modified Murakami discloses all of the claim limitations as set forth above, but does not explicitly disclose the area of the contact surface between the finger electrodes and the semiconductor region is represented by  $S_1$ , an average value of distances between the edge lines of the contact surface within each cut surface formed by cutting at a plurality of cut planes that are generally perpendicular to the direction of electric current flowing through the finger electrode is represented by  $d_1$ , and an entire length of the edge lines is represented by  $L_1$ , the solar cell elements each include at least one finger electrode where the values  $S_1$ ,  $d_1$ , and  $L_1$  satisfy the following relationship:  $0.5L_1(S_1*d_1^{-1}+d_1)^{-1} > 1.2$ . As the amount of contact surface area between the finger electrodes and semiconductor region is a variable (both dependent upon edge lines and electrode width), that can be modified, among others, by adjusting semiconductor region roughness, with said contact surface area between the finger electrode and semiconductor region increasing as roughness of the semiconductor region is increased, the precise surface roughness would have been considered a result effective variable by one having ordinary skill in the art at the time the invention was made. As such, without showing unexpected results, the claimed relationship between finger electrode size and surface roughness cannot be considered critical. Accordingly, one of ordinary skill in the art at the time the invention was made would have optimized, by routine experimentation, the surface roughness in the apparatus of modified Murakami to obtain the desired balance between the amount of contact surface area



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between the finger electrode and semiconductor region (*In re Boesch*, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)), since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. (*In re Aller*, 105 USPQ 223).

10. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami (US 5,380,371) in view of Hanoka et al. (US 5476553).

Regarding claim 13, Murakami discloses all the claim limitations as set forth above but does not explicitly disclose a plurality of solar cells connected together to form a solar cell module.

Hanoka discloses a solar cells connected together in series or parallel so that each module has a predetermined voltage and current output (C5/L41-45).

It would have been obvious to one having ordinary skill in the art at the time of the invention to connect a plurality of the solar cell of Murakami to make a module, as taught by Hanoka, in order to get a predetermined voltage and current output.

11. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Murakami (US 5,380,371) in view of Gochermann et al. (US 4540843).

Regarding claim 22, Murakami discloses all the claim limitations as set forth above but does not explicitly disclose the back electrode comprising bus bars.

Gochermann discloses using bus bars (11) on the back surface of the solar cell (16), in order to allow for incident light on both sides of the cell, resulting in larger surface area available for radiation and higher efficiencies, and allows for heat radiation

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to pass through the cell, resulting in lower operating temperatures (abstract, C1/L50-62).

It would have been obvious to one having ordinary skill in the art at the time of the invention to replace the planar rear electrode with the bus bar configuration from the front, on the rear of the cell in the device of Murakami, as taught by Gochermann, in order to allow for incident light on both sides of the cell, resulting in larger surface area available for radiation and higher efficiencies, and allow for heat radiation to pass through the cell, resulting in lower operating temperatures.

### ***Response to Arguments***

12. Applicant's arguments filed April 9, 2010 have been fully considered but they are not persuasive.

Regarding arguments towards claim 1, that Murakami fails to reveal three bus bar electrodes comprising a first surface bus bar electrode, and a second and third bus bar electrodes located on both sides of the first bus bar electrode with a gap and arranged symmetrically, the examiner respectfully disagrees. As stated in the rejection above, Murakami discloses the three bus bars in Fig. 1C (see insert above), and examiner notes that the claim limitations to exclude a comb configuration, because the teeth of the comb read as separate bus bar electrodes because they collect electricity from the finger electrodes (108).

Regarding arguments towards claim 1, that Murakami fails to teach finger electrodes which are contacted to both adjacent surface bus bar electrodes, the examiner respectfully disagrees. As stated in the rejection above, Murakami discloses

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the finger electrodes (108) in contact on both sides of each bus bar in Fig. 1C (see insert above).

Regarding arguments towards claims 5-6 and 8-10 (pages 12-13 of arguments), applicant relies on the arguments concerning claim 1, which have been addressed above. The rejections are therefore considered proper and maintained.

### ***Conclusion***

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allison Bourke whose telephone number is (571)270-1232. The examiner can normally be reached on Monday-Thursday 8:30am-5pm and every other Friday 8:30am-5pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on (571) 272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. B./  
Examiner, Art Unit 1795

/Jeffrey T. Barton/  
Primary Examiner, Art Unit 1795  
26 August 2010